1. Introduction

This *Puget Sound Update* is the eighth report of the Puget Sound Ambient Monitoring Program (PSAMP). Since the first report was published in 1990, the results of the monitoring work reported here have become increasingly vital as pressures on the natural resources in Puget Sound rise and our understanding of the interrelated nature of the ecosystem grows. Both of these trends argue for increasingly sophisticated management of Puget Sound's resources—management based on scientific data and evaluated by achievement of objectives as reflected in this scientific data.

The increasing use of Puget Sound's natural resources is directly tied to the area's continuing high rate of population growth (OFM 2002). This growth leads to land conversion for new development and associated changes to watershed hydrology and contaminant transport to the marine environment. The increasing population may also be associated with an increase in recreational fishing harvest, recreational boating and residential and commercial shoreline development. All of these activities represent uses of Puget Sound's natural resources that must be carefully managed to sustain the integrity of these resources and ultimately the overall health of the ecosystem.

Many governments (tribal, local, state and federal) and non-governmental organizations in Puget Sound are engaged in monitoring activities designed to contribute to the management of the region's natural resources. Most of these efforts focus on particular areas of Puget Sound, for example, within a government's jurisdiction, or on a particular facet of the ecosystem within an agency's responsibility. In 1988, the State of Washington initiated PSAMP as a monitoring program to encompass the greater Puget Sound region with a broad, interdisciplinary approach.

The Puget Sound Ambient Monitoring Program

The *1987 Puget Sound Water Quality Management Plan* identified the lack of a long-term comprehensive program to monitor Puget Sound and its resources. PSAMP was designed to fill this need by bringing a number of existing monitoring efforts under one management structure and initiating new efforts where needed. Under the authority of the Puget Sound Water Quality Action Team (Action Team) and the *Puget Sound Water Quality Management Plan*, two committees direct and oversee the design and implementation of PSAMP. These committees are composed of scientists and managers from government agencies that help implement the program.

Government agencies that participate in PSAMP and the focus of their monitoring activities include:

- Washington State Department of Ecology
  Marine sediment, marine water and fresh water.
- Washington State Department of Fish and Wildlife
  Contaminant burdens and abundance of fish, marine birds and marine mammals.
- Washington State Department of Natural Resources
  Nearshore habitat.
- Washington State Department of Health
  Nearshore marine water (shellfish growing areas).
- King County Department of Natural Resources and Parks
  Marine water, sediment and shellfish.
- U.S. Fish and Wildlife Service
  Bird contaminants.
- National Marine Fisheries Service
  Contaminant burdens and associated health effects in fish.
- U.S. Environmental Protection Agency
  Technical and programmatic support. Sponsorship of targeted studies.
- Puget Sound Water Quality Action Team
  Coordination of PSAMP activities and management.

PSAMP reports its results and analyses through individual agency technical reports, scientific meetings and various briefings and documents prepared for managers, legislators and regional working groups. The *Puget Sound Update* is a technical document that integrates results from all of the PSAMP components and serves as an overall program report issued every two years.

Scope and Structure of this Report

This report includes results from the breadth of the PSAMP monitoring activities conducted by all the participating agencies. This is a technical report, but it does not include the methodological and analytical detail found in individual agency technical reports. This report attempts to answer the questions of citizens, lawmakers, resource managers and scientists about the condition of Puget Sound's waters, sediments and its biological resources.

The goal of the *Puget Sound Update* is to provide information that can help readers evaluate current efforts to protect and restore Puget Sound's water quality and to point out water quality and resource management issues that might require attention now and into the future.

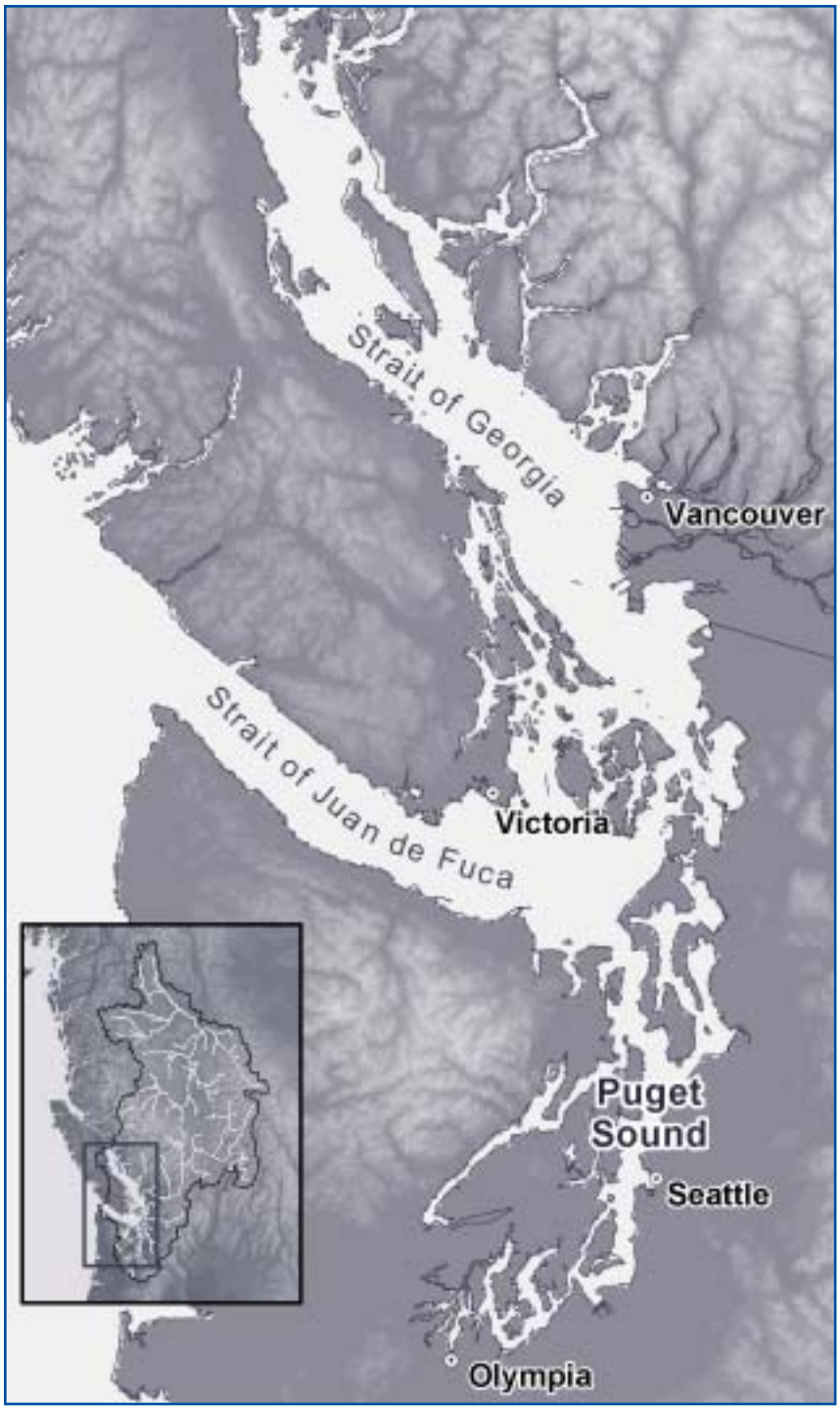

Figure 1-1. Puget Sound, the straits of Georgia and Juan de Fuca and the associated drainage basin.

Data source: HYDRO 1K dataset, U.S. Geological Survey

PSAMP uses the *Puget Sound Update* to report on its own results but also to summarize the related work of other researchers in Puget Sound as well as the larger region. The geographic scope of PSAMP is formally the inland marine waters of the State of Washington, including Puget Sound proper, part of the Strait of Juan de Fuca and the southern portion of the Strait of Georgia. In this report, the term Puget Sound is used in a broad sense to represent all these inland marine waters of Washington. In many respects, however, these marine waters of Washington are part of a single larger ecosystem that includes the entire Strait of Georgia in British Columbia (Figure 1-1). This is reflected in this report through a number of monitoring activities that are either transboundary in nature or focus on the Strait of Georgia.

PSAMP's monitoring topics and integrated questions

PSAMP organizes its monitoring and reporting by topics that relate to specific ecosystem characteristics or human-influenced stresses on the environment:

Physical Environment: Are the physical environments of Puget Sound changing and, if so, how do these changes affect Puget Sound's biological resources?

Pathogens and Nutrients: What are the status and trends of pathogen and nutrient contamination in Puget Sound? How do they affect the Sound's biological resources?

Toxic Contamination: What are the status and trends of contamination in Puget Sound? How does toxic contamination affect the Sound's biological resources?

Human Health: What are the risks to human health from consuming seafood from Puget Sound?

Biological Resources: What are the status and trends of Puget Sound's biological resources?

Although the marine waters of Washington and British Columbia mix freely, the international border creates an institutional barrier, making it challenging to develop and share information or coordinate management programs concerning the broader ecosystem. To address this, the governor of Washington State and the premier of British Columbia entered into an Environmental Cooperation Agreement in 1992 to foster cooperation and collaboration. The joint publication of the Georgia Basin – Puget Sound Environmental Indicators Report (GBEI 2002) released earlier this year is evidence of this increasing cooperation. Also, next year's biennial research conference will be an international effort, with joint sponsorship from both sides of the border. The 2003 Georgia Basin–Puget Sound Research Conference will be in Vancouver, British Columbia. Future editions of the *Puget Sound Update* will no doubt further reflect this growing cooperation.

This report is organized around five monitoring topics (see sidebar) that relate to human activities and management programs. Each of the next five chapters of the *Update* addresses one monitoring topic, beginning with a summary of the issues addressed by the topic and followed by a presentation and discussion of recent findings from PSAMP and other studies. A number of monitoring activities fall into more than one category. Cross-references between chapters are provided where this occurs.

Monitoring and research results, as presented in this *Puget Sound Update*, help regulatory agencies and the Puget Sound community understand how our ecosystem functions and how it responds to human activities and management programs. Through presentation of its findings, PSAMP can raise awareness of problems and issues affecting Puget Sound. In some cases, monitoring results from PSAMP and other studies will indicate the need for additional scientific investigation. In other cases, monitoring results may directly indicate the need for new policies, amended strategies or specific measures to protect and restore Puget Sound resources. Each of the remaining chapters of the *Update* concludes with a short list of recommendations for acting on the findings presented in the chapter.